DECLARATION

I hereby declare that the project is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at USM or any other institutions.

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(Signature)

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DATE: July 10, 2009

The Impact of Macroeconomic Volatility on Bursa Malaysia Volatility

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ABSTRAK

Kajian ini dijalankan untuk mengkaji kesan volatiliti makroekonomi terhadap volatiliti Bursa Malaysia untuk data siri masa bulanan dari Januari 1990 ke Disember 2008. Pembolehubah makroekonomi yang digunakan termasuk pengeluaran industri, penawaran wang, kadar bunga, kadar pertukaran, kadar inflasi dan harga minyak. Kajian ini dibahagikan kepada empat tempoh masa iaitu sebelum krisis, krisis I (kadar pertukaran bebas), krisis II (kadar pertukaran tetap) dan selepas krisis. Kaedah yang telah diaplikasikan dalam kajian ini untuk mangkaji kesan makroekonomi volatiliti terhadap *KLCI* volatiliti ialah ICAPM dan GARCH untuk menjangka kadar pulangan *KLCI*. Keputusan empirika menunjukkan volatiliti Bursa Malaysia dipengaruhi oleh volatiliti makroeconomi. Volatiliti penawaran wang dibuktikan sebagai faktor yang kuat untuk mempengaruhi volatiliti Bursa Malaysia sebelum krisis dan selepas krisis. Volatiliti kadar bunga juga telah dibuktikan sebagai pengaruh volatiliti Bursa Malysia sebelum krisis dan semasa krisis pada kadar pertukaran tetap.

ABSTRACT

This study is undertaken with the objective to examine the behavior of Bursa Malaysia volatility with respect to macroeconomic volatility for time series data cover period from January 1990 to December 2008. The macroeconomic variables used include industrial production, money supply, interest rate, exchange rate, inflation rate and oil price. The analyses were divided into four sub-periods to include pre-crisis, crisis I (flexible exchange rate), crisis II (fixed exchange rate), and post crisis. The approach adopted by this study to examine the impact of macroeconomic volatility on *KLCI* volatility is ICAPM with GARCH properties to estimate the *KLCI* return. The empirical findings indicated that the Bursa Malaysia volatility was affected by macroeconomic volatility. The volatility of money supply significantly influenced the Bursa Malaysia volatility before crisis and after crisis while interest rate volatility significantly influenced Bursa Malaysia volatility before crisis and during fixed exchange rate period.

Chapter 1

INTRODUCTION

1.1 Introduction

The performance of the stock market is influenced by many different factors. The economic performance of a country is the most important factor which determines the performance of the stock market. During an economic expansion, the stock market will rise while during economic recession, the stock market will fall. Since the stock market is very sensitive towards the economic growth of a country, it has become the topic of interest for many researchers to study the relationship between macroeconomic fundamentals and the stock market.

Generally, the stock prices do not behave constantly in its performance. It is usually change by moving up and down. If the stock prices change rapidly over a short period of time, it is considered to have high volatility. In contrast, if the stock prices are almost constant or only have little changes, it is considered to have low volatility. So, volatility has become the most important factor to consider in making investment decision in stock market. The interesting question is that what factors have driven the volatility in stock market?

With respect to the above question, this paper will investigate the behavior of the Bursa Malaysian volatility which can be explained by the macroeconomic volatilities.

1.2 Background

Malaysia is a small trade-dependent economy with high response to global development. Bursa Malaysia is the only stock exchange in Malaysia. It was formerly known as Kuala Lumpur Stock Exchange (KLSE). Study about stock market is commonly refers to the performance of stocks as a whole and most researchers use Kuala Lumpur Composite Index (*KLCI*) as a measure of Bursa Malaysia performance. This index is also an economic indicator which reflects the growth of Malaysian economy.

The volatility of *KLCI* keeps changing with different cycle of economic. It is believe that stock return volatility is related to economic condition. In Western country, the concern about stock market volatility started after 1987 where the stock market in the United States crashed on October 19, 1987 and stock prices dropped on October 13, 1989. While in Asia market, the study of volatility started during and after Asian Financial Crisis 1997. In Malaysia, *KLCI* fell from the highest of 1216.72 at the end of January 1997 to 594.44 at the end of December 1997, over 622 points.

Several factors may determine the changes in stock market volatility. Schwert (1990) claims that stock market volatility reflect changes in financial leverage, operating leverage, personal leverage and the condition of the economy. Volatility in the stock market also associated with the arrival of new unanticipated information. Some

researchers also argue that stock volatility is caused by trading volume and short-term trading activities in the domestic stock market.

This paper aims to study the Bursa Malaysia volatility based on the changes in macroeconomic activity. Stock prices reflect the value of anticipated future profits of companies. Since the growth of companies depends on domestic macroeconomic condition, Bursa Malaysia is closely associated with the performance of economic and production sector in Malaysia. Good economic performance will lead to higher production. When economy turns bad, the growth of companies will be affected and it may influence the current share price as postulated by the dividend discount model. Consequently, stock market return definitely will be affected when economic condition change.

Moreover, a company's growth may also incorporate possible integration with foreign market through its major trading partners. The co-movement of macroeconomic indicators across countries may influence the co-movement of stock prices in domestic market. Changes in exchange rate may be unfavorable because such changes may impair the smooth functioning of a company's cash flows and eventually financial system may be adversely affected.

1.2.1 What is stock market volatility?

A simple way to show stock market volatility is to measure the percentage change in price or rate of return. Table 1.1 gives the 20 highest and lowest monthly returns for *KLCI* from January 1990 to December 2008. As noted, April 1999 has the largest monthly percentage increase in stock prices (29.44 percent). The next largest change in stock prices occurred in August 1998, when stock prices dropped 28.46% prior to the capital control on September 1, 1998. After the severe drops of stock prices between 1997 and 1998, stock market rebounded in September 1998 with the fifth largest gain in the sample (20.95%). This implies that the *KLCI* started to recover with the introduction of capital control and fixed exchange rate imposed by the Malaysian government.

In fact, volatility is considered as a measure of risk. As could be seen from Table 1.1, the higher the volatility of stock represent the higher the return. Basically, the measurement of volatility is the standard deviation of return. As a measure of dispersion, large value of standard deviation would mean large volatility and the probability of getting high positive or negative return is large. Using standard deviation as a measure for volatility, the volatility could be computed from the following formula:

$$\hat{\sigma}_t = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(R_i - \overline{R})^2}$$

Table 1.1:

The 20 Highest and Lowest KLCI Monthly Percentage Return, 1990-2008

	Lowest		***Highest***	
1	**Aug-98**	-28.46%	**Apr-99**	29.44%
2	**Aug-97**	-23.04%	**Feb-98**	26.91%
3	**Oct-97**	-20.33%	**Dec-93**	24.68%
4	**Nov-97**	-19.77%	**Nov-98**	21.28%
5	**Mar-94**	-16.68%	**Sep-98**	20.95%
6	**Jun-98**	-16.66%	**Dec-98**	15.60%
7	**Oct-08**	-16.51%	**Oct-93**	12.96%
8	**Sep-90**	-16.39%	**Jan-00**	12.67%
9	**Aug-90**	-15.30%	**Feb-91**	12.31%
10	**May-98**	-15.10%	**May-90**	11.48%
11	**Jan-94**	-14.16%	**Apr-93**	11.22%
12	**Apr-98**	-13.93%	**Oct-03**	10.80%
13	**Sep-99**	-12.72%	**Jul-01**	10.62%
14	**Jul-98**	-12.36%	**Feb-95**	10.35%
15	**Apr-90**	-11.43%	**Apr-94**	10.15%
16	**Sep-01**	-11.04%	**Dec-99**	10.05%
17	**Sep-00**	-10.92%	**May-95**	9.82%
18	**Sep-02**	-10.88%	**May-99**	9.61%
19	**Apr-97**	-10.78%	**Oct-99**	9.51%
20	**Apr-01**	-10.23%	**Aug-94**	9.51%

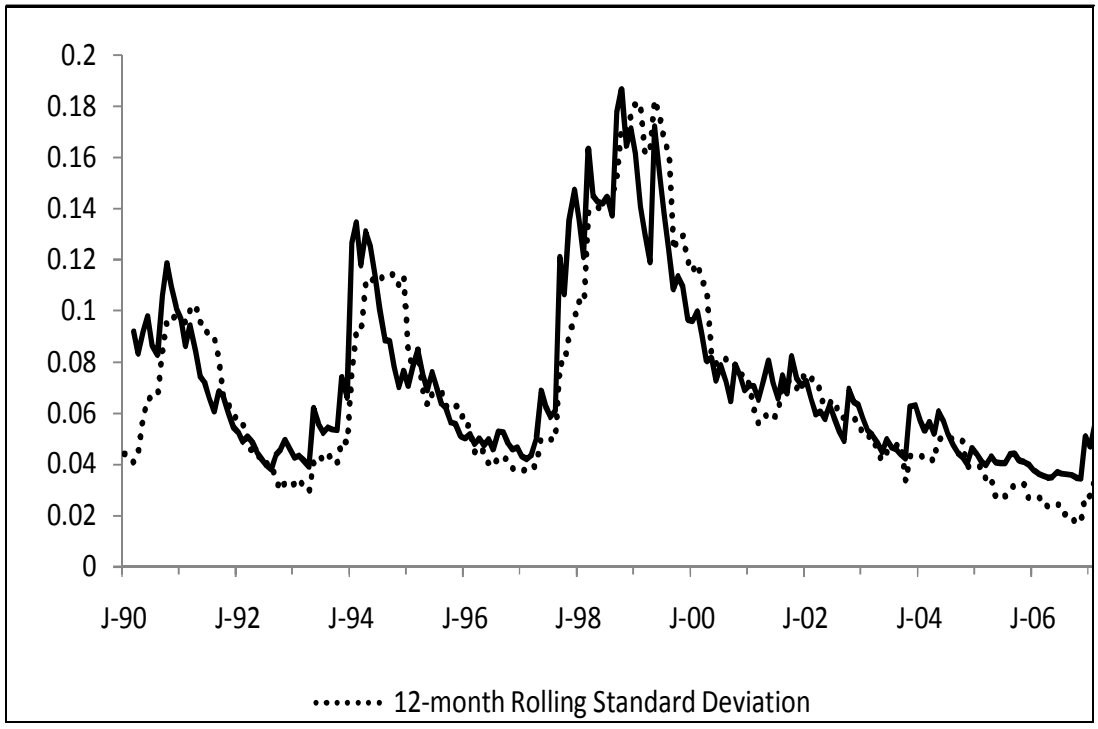
where $\hat{\sigma}_t$ is the standard deviation of stock return; $\overline{R}$ is average stock return and R_i is the stock return at period *i*. This measure is a nonparametric measure of return volatility. Officer (1973) apply 12-month rolling standard deviation to compute volatility of returns over successive periods of time by rolling the window forward in time, that is drop month 1 and add month 13. Figure 1.1 shows this simple method to compute the volatility of *KLCI* from January 1990 to December 2008. One potential problem with this approach is that the use of overlapping observations will create correlation between standard deviation at different points in time.

Figure 1.1. 12-month rolling standard deviation for KLCI, January 1990 – December 2008.

Alternatively, many researchers started to study and measure the volatility of stock return using ARCH (proposed by Engle, 1982) and GARCH (proposed by Bollerslev, 1986) model - the parametric model. GARCH models have been successfully applied to financial time series and have become the most popular tools to study the behavior of volatility. Pagan and Schwert (1990) showed that GARCH model perform quite well as an alternative models for conditional stock return volatility and GARCH(1,1) is enough to account for most financial time series. Cunado et al (2004) also proved that GARCH(1,1) reproduce quite well the behavior of rolling variance in Spanish stock market.

Figure 1.2 shows the 12-month rolling standard deviation of *KLCI* and the standard deviation estimated by GARCH(1,1) model. Clearly, GARCH model could be an alternative model to plot the standard deviation of *KLCI*. Comparing Figure 1.2 of rolling standard deviation and GARCH standard deviation with Table 1.1, it can be seen that months with extreme returns also have high standard deviations. In 1999, *KLCI* volatility exceeded 16%. Months like April 1999 and February 1998 with highest return also show up to have high volatility in Figure 1.1.

Figure 1.2. 12-month rolling standard deviation and GARCH(1,1) conditional standard deviation for KLCI, January 1990 – December 2008.



1.2.2 Macroeconomic Volatility

Figure 1.3 presents time series plots of conditional volatilities of all macroeconomic variables used in the study. Most series display considerable time variation in their volatilities. On particular, exchange rate and interest rate have high volatility during Asian financial crisis. For instance, at first glance, *KLCI* volatility appears to be related to interest rate volatility and exchange rate volatility during Asian financial crisis since the volatility of these variables is high during the period. The money supply volatility also coincides with *KLCI* volatility as it shows peaks during the year 1994 and during financial crisis of 1998-1999. Alternatively, macroeconomic volatility may well be related to stock return volatility and help to explain Bursa Malaysia volatility.

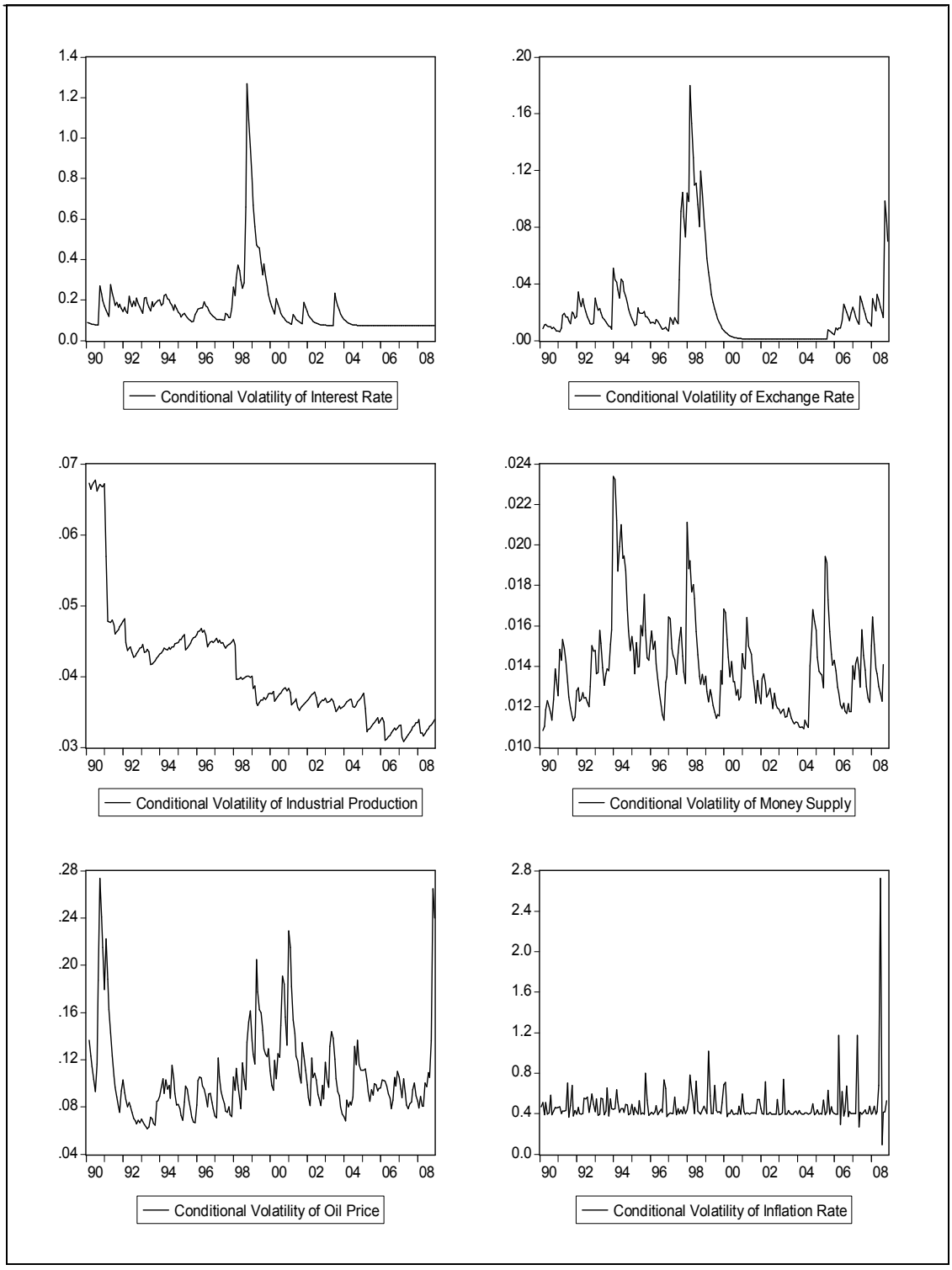
1.3 Research Objectives

In view of the proposition of the relationship between macroeconomic and *KLCI* volatility, this study will examine the impact of macroeconomic volatility and the Bursa Malaysia volatility. The objectives of this study are:

1. To investigate the impact of macroeconomic volatilities to Bursa Malaysia volatility.

2. To examine whether the relationship of macroeconomic volatilities and Bursa Malaysia volatility varies across different sample periods.

Figure 1.3. Time series plot of the conditional volatility of all macroeconomic variables.



1.4 Problem Statement

The increasing globalization of the world has created economic growth in Malaysia. Substantial development of technology allows traders and investors to react quickly to any information. If the efficient market hypothesis holds, various sources of news may have an impact on the stock market return. Moreover, as a result of globalization, there are less restriction controls on asset market transaction and thus increase capital flows between countries. New information spreads more quickly from one financial market to another and thus accelerates the response of investors to the information. The global investment world has caused stock prices to change quickly and high levels of volatility in various markets including Malaysia. Stock market in Malaysia is closely associated and integrated with international and global stock markets. Such integration tends to provide price movement between international stock market and could significantly reduce benefits from international portfolio diversification.

One important hypothesis raised by Schwert (1989, pp. 1115-1116), "*Though stock return volatility did not stem from innovations in dividends or discount rates, it may be proportional to the volatility of expected future cash flows revealed in macroeconomics factors like inflation, industrial production, money growth, unemployment and other measures of economic activity."* In other words, any shock on macroeconomic or macroeconomic volatility must impact the stock market volatility. This raises the concern about the growth of a country's economy and stability of

financial institutions. Extremely high volatility in economic could disorder the smooth functioning of financial system.

As a result, the volatility of stock market is the most concern of investors, analysts, brokers and dealers in Malaysia. Changes in the level of Bursa Malaysia volatility which associated with higher risk could have important effects on capital investment and consumption. It is not only important to investors and portfolio managers but also to international economic and financial policy makers. Investors will always check for volatility of stock prices and other variables in order to confirm whether they could gain or loss. For example, if investors find that the exchange rate is too volatile, there might be trouble for the trade sector, and thus the performance of the listed companies that have substantial international trade or even international project might get affected. This will spur selling pressures on the related companies and could snowball into high stock market volatility. Another example is when interest rate is changing frequently, and hence high interest rate volatility, investors in stock market might find the cost of investing become high. They might shift to the bond market, and hence the selling pressure will create stock market volatility as well.

High stock volatility could mean huge losses or gains and hence greater uncertainty for the listed companies. Increase in the Bursa Malaysia volatility would mean increase in the cost of business for the listed firms. On the other hand, it also indicates an increase in the risk of equity investment and investors will shift their funds to less risky asset such as property and bond. Moreover, high volatility appears to create difficulty in decision making among policy makers since volatility will trigger higher

uncertainty. This is because the rising of stock prices are often expected but the falling of stock prices are difficult to predict. Hence, structural and regulatory changes may be necessary to increase the resiliency of Bursa Malaysia in term of greater volatility. As a conclusion, knowledge of volatility becomes important in the measurement of risk.

This study attempts to find the linkages of macroeconomic volatility and Bursa Malaysia volatility. Although many study in Malaysia examine the relationship between macroeconomic variables and the stock market behavior, their study focus on fundamentals macroeconomic causes on Bursa Malaysia. Researches in the past are also aim to find out how to measure stock market volatility. There is less agreement on the causes of macroeconomic volatility on Bursa Malaysia volatility. As such, this study will fill in the gap of academic research in financial market by focusing on the issue of volatility.

1.5 Definition of Key Terms

Volatility refers to conditional standard deviation of stock returns, percentage change in exchange rate, growth rate of industrial production, growth rate of money supply, percentage change in oil price, interest rate and inflation rate.

$R_{KLCI,t}$ is stock return at month t and it is defined as percentage change in stock price and it is given as $\log\left(\frac{P_t}{P_{t-1}}\right)$.

Exchange rate is defined as the price of Ringgit Malaysia in exchange for a unit of U.S. Dollar. $R_{EXR,t}$ is percentage change in exchange rate at month t and it is given as $\log\left(\frac{EXR_t}{EXR_{t-1}}\right)$.

Industrial production is defined as output from industry sector. $R_{IP,t}$ is growth of industrial production at month t and it is given as $\log\left(\frac{IP_t}{IP_{t-1}}\right)$

Money supply is the amount of money available in an economy. R_{M2} is growth of money supply at month t and it is given as $\log\left(\frac{M2_t}{M2_{t-1}}\right)$.

Oil price is the crude oil spot price per barrel. $R_{OIL,t}$ is percentage change in oil price at month t and it is given as $\log\left(\frac{Oil_t}{Oil_{t-1}}\right)$

Interest rate is defined as rate of return promised by a borrower to a lender and BLR_t is interest rate at month t.

Inflation rate is defined as percentage change in the consumer price index from one month to the next month and INF_t is inflation rate at month t.

1.6 Research Question

The implication of this study is that there should be a relationship between macroeconomic volatility and Bursa Malaysia volatility. The following research question aim to find solution for the problem statement.

1. Does the macroeconomic volatility help to explain the Bursa Malaysia volatility before crisis, during crisis flexible exchange rate, during crisis fixed exchange rate period, and after crisis?

2. What are the key determinants that impact most to the Bursa Malaysia volatility before crisis, during crisis flexible exchange rate, during crisis fixed exchange rate period, and after crisis?

1.7 Significance of the Study

This study aims to examine the impact of macroeconomic volatility to the Bursa Malaysia volatility. It is hoped that the findings of this study would provide some meaningful insights to the body of knowledge, policy makers as well as practitioners. This research findings will enhance the importance of the risk management and decision analysis, specifically addresses the impact of macroeconomic volatility (as a component of systematic risk) in the Bursa Malaysia.

By knowing which macroeconomic variables affect the Bursa Malaysia the most, both personal and corporate investors would be able to allocate their resources to increase profits and change their investment strategies according to the change of monetary policy. For academic field, the result from this study would contribute to the theoretical framework of the determinants of stock market volatility for emerging market like Malaysia. For the policy implication, it is hoped that the findings would help the regulatory bodies to better understand Bursa Malaysia volatility towards achieving the desired goals.

1.7 Organization of Remaining Chapters

The structure of this paper is as follows. In Chapter 2, literature reviews of previous studies, theoretical framework and hypotheses development. This paper begins with a thorough literature review and establishes the theoretical and empirical justification for modeling the stock market volatility and the macroeconomic volatility.

Chapter 3 describes the methodology used in this study by firstly discussing the data set. Then, it is followed by the discussion on the measures of the volatility of *KLCI* and the fundamental variables. Lastly, this chapter will discuss the data analysis which include unit root test and multiple regression analysis for each sub-period.

Chapter 4 will report all the analysis result and the Chapter 5 will provide discussions and concluding remarks based on the findings from Chapter 4. The limitations and suggestions for future research are also provided in Chapter 5.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This chapter offers three major topics. Section 2.2 provides current and relevant literature review. Section 2.3 and 2.4 are theoretical framework and hypothesis development.

Section 2.2 offers a summary of the literature review on the research issue. There are two categories of studies on macroeconomic influences on stock return. The first category focuses on the impact of macroeconomic fundamentals to the stock market return whereas the second category studies the causes of stock market volatility. This chapter will also cover the literature on each of the variables and their relationship with stock market.

Theoretical framework is discussed in Section 2.3. The underlying theory that supports the relationship between macroeconomic volatility and stock return volatility is provided in this section. Section 2.3 also provides further justification for the variables chosen. One empirical model is developed for the purpose to study the relationship between macroeconomic volatility and Bursa Malaysia volatility. Section 2.4 offers hypothesis development. The directional relationship between macroeconomic volatility and *KLCI* volatility is specified.

2.2 Literature Review

2.2.1 Impact of macroeconomic fundamentals to the stock market performance

Macroeconomic variables play a key role in determining stock market return in Capital Asset Pricing Model (CAPM). A number of studies have investigated the stock returns using macroeconomic variables and they show that there is a linkage between macroeconomic condition and stock market return.

Rapach *et al.* (2005) examined a large set of macro variables and provided evidence to show that stock can be predicted using macro variables. The macro variables that they considered include inflation rate, money stocks, interest rates, terms spread, industrial production and employment rate. They showed that interest rate was the most consistent and reliable predictors of stock return across 12 industrialized countries namely Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, UK and US.

Chen (2009) further investigated the Standard & Poor's S&P 500 price index and suggested that interest rates and inflation rates were the most useful predictors of recessions in the US stock market, according to both in-sample and out-of-sample forecasting performance. The series of macroeconomic variables which have been evaluated are interest rate spreads, inflation rates, money stocks, aggregate output, unemployment rates, federal funds rates, federal government debts and nominal exchange rates.

On the other hand, the relation between stock return and macroeconomic variables for the ASEAN-5 countries (namely Indonesia, Malaysia, Philippines, Singapore and Thailand) has been reported by Wongbangpo and Sharma (2002). They explored both long-run and short-run relationships between the respective country's stock price indexes and macroeconomic variables of gross national product (GNP), the consumer price index (CPI), the money supply, the interest rate, and exchange rate. They found that all five stock price indexes are positively related to growth in output and negatively to the aggregate price level for long-term and short-term. But a negative long-run relationship between stock prices and interest rates was noted for the Philippines, Singapore, and Thailand, and was found to be positive for Indonesia and Malaysia.

In Malaysia, the relation between stock returns and macroeconomic variables has been broadly investigated by Ibrahim *et al.* (2001; 2003). Ibrahim and Wan Yusoff (2001), attempted to evaluate the dynamic interactions among stock price (*KLCI*), the exchange rate and three macroeconomic variables namely real output, price level and money supply. By applying time-series techniques of cointegration and vector autoregression (VAR), they found that macroeconomic variables and exchange rate could improve the predictability of the Malaysian equity prices. Pyeman and Ahmad (2007) also found that share price in Malaysian Stock Market is sensitive to macroeconomic fundamental.

Moreover, Ibrahim and Aziz (2003) again investigated the relationship between stock prices and industrial production, money supply, consumer price index, and exchange rate. They had applied cointegration and Vector Autoregressive (VAR) on

monthly data from January 1977 to August 1998. Different with the study of Ibrahim and Wan Yusoff (2001), this study implements rolling regressions of the VAR model to gain further insights on the dynamics linkages among the stock prices and macroeconomics variables. They found the presence of a long-run relationship between these macroeconomic variables and the stock prices and substantial short-run interactions among them.

Study by Abdul Rahman *et al.* (2009) recently highlighted clearer direction for the relationship between macroeconomic and stock market. They showed that the Malaysian stock market is sensitive to changes in the macroeconomic variables. They claimed that money supply, exchange rate, reserves, interest rate and industrial production have significant long run effects on Malaysia stock market under VECM framework. They highlighted that the relation of *KLCI* with reserve and industrial production is stronger compared to money supply, interest rate and exchange rate.

One obvious conclusion could be made based on the literature review in this section. Macroeconomic could determine and predict stock market return but a standard set of macroeconomic variables is not documented.

2.2.2 Impact of macroeconomic volatility to the stock market volatility

Following Schwert (1989), the relationship between macroeconomic volatility and stock return volatility has been widely examined in many countries. The earliest

literature review was based on Chiang and Chiang (1996). Chiang and Chiang (1996) examined the impact of predicted money growth volatility, predicted real output volatility, predicted exchange rate volatility and predicted U.S. stock return volatility on four countries stock return volatility (namely Canada, Japan, United Kingdom and Germany). The findings from Chiang and Chiang (1996) showed that the correlation between macroeconomic volatility and stock return volatility is weak but the U.S. stock return volatility has a significant positive impact on those four countries' stock return volatility. Volatility of money supply growth and real income growth were found to have some impact on stock return volatility.

Kearney and Daly (1998) examined the determinants of Australian stock market volatility from July 1972 to January 1994. They presented evidence that conditional volatility of interest rate and inflation rate are directly related to Australian stock market volatility whereas money supply, industrial production and current account deficit are indirectly related to Australian stock market volatility. Among these variables, money supply was found to be the most significant variable but exchange rate had no significant relationship with Australian stock market volatility.

Sardosky (2003) studied the macroeconomic determinants of technology stock price volatility in U.S. technology stock price volatility. The empirical results shown by Sardosky (2003) proved that the conditional volatilities of oil price movements, the term premium and the consumer price index each have significant impact on conditional volatility of technology stock prices. Sardosky (2003) concluded that macroeconomic volatility can help to predict conditional stock market volatility.

In the United States, Beltratti and Monara (2006) documented S&P 500 returns volatility and found strong existence of causality linkages from macroeconomic volatility to stock market volatility but stock market volatility exercises only a limited influence on macroeconomic volatility. The macroeconomic variables that they studied are money growth, inflation, Federal funds rate and output growth. Particularly, the prolonged period of high stock market volatility during the phase of economic expansion is associated with an increase in money growth volatility.

The latest study includes Abugri (2008), investigates empirical relationship between macroeconomic volatility and stock return four emerging market of Latin America countries (Argentina, Brazil, Chile and Mexico). Using six-variable vector autogressive (VAR) model, Abugri (2008) investigated a set of macroeconomic indicators like exchange rates, interest rates, industrial production and money supply to the stock returns. Besides the macroeconomic indicators, Abugri (2008) also considered global factors and thus he included Morgan Stanley Capital International (*MSCI*) and U.S. 3-month T-bill yield as a proxy for global factors. The results showed that volatility of the stock market returns are generally high and that shocks from the country macroeconomic variables are transmitted to the markets at varying magnitudes and significance level. Also, the global factors appear to have the most consistent effects on all the four markets. The global factors are more important than the domestic variables in explaining return across markets.

The literature in Malaysia is still less compared to developed market. In Malaysia, the relation between selected macroeconomic variables and stock market volatility has

been studied by Cheong and Tan (2000) and Tan and Law (2003). Cheong and Tan (2000) examine the exchange rate, industrial production, inflation rate, interest rate and money supply covering the monthly data from January 1991 to December 2001 and found that these macroeconomic risks were significantly affected the stock excess return in the post-crisis period. They also showed that the degree of persistence in shock was lowered in the market during the post-crisis period. This paper typically studies the linkage between stock excess return and macroeconomic volatility. Hence the links between macroeconomic volatility and stock market volatility remain largely unstudied.

Other than that, Tan and Law (2003) employed the weekly data set from 2 May 1996 to 15 September 1999; only examined exchange rate risk and interest rate risk impact on stock prices before and during the Asian financial crisis. The stock prices were proxy by the three indices, namely Composite index, the EMAS index and the Second Board Index. They applied Exponential-Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model to estimate the volatilities of exchange rates and interest rates. Using the VAR model to analyze the dynamic impact of the variables, they found that the volatility of exchange rate and interest rate were not leading the stock prices (CI, EMAS and Second Board) before the crisis. Also, the impact of exchange rate volatility on KLSE stock prices was more significant than the interest rate volatility during the Asian crisis. Again, this paper only examines the impact of exchange and interest rates volatility on stock prices and hence ignores to document the relation of macroeconomic volatility and stock return volatility.

However, there are studies reveal that macroeconomic volatility cannot explain stock return volatility. Schwert (1989) identified and showed empirically that there is no strong evidence of a relation between stock market volatility and other measure of economic volatility such as inflation and money growth volatility for the U.S. stock market. In United Kingdom, the relationship between conditional stock market volatility and conditional macroeconomic volatility was examined by Morelli (2002). Using Autoregressive Conditional Heteroscedastic (ARCH) models, Morelli (2002) examined U.K. data covering the period January 1967 to December 1995 and concluded that the volatility in the macroeconomic variables (namely industrial production, real retail sales, money supply, inflation and exchange rates) do not explain the volatility in the stock market in the UK.

As a summary on this section, studies in developed countries found mixed result on the relationship between macroeconomic volatilities and stock return volatility. However, the studies in Malaysia were limited to macroeconomic volatilities impact on stock return or excess return. Study on the impact of macroeconomic volatilities to stock return volatility in Malaysia is still subject to further research.

2.2.3 Studies of the independent variables

Exchange rate

The study of the impact of exchange rates to the stock market has been examined by many researchers. Lee and Solt (2001) showed that German, Japanese, and U.S. excess stock returns vary directly with changes in the real terms of trade as well as with

exchange rate changes induced by the macroeconomic factors. In German and US and to some extent Japanese, real excess stock returns vary directly with the exchange rate factors indicating that currency depreciation (appreciation) leads to higher (lower) stock returns (Lee & Solt, 2001). They studied a data of 288 observations from December 1972 to December 1996 and stock return indices namely Frankfurt Exchange, Tokyo Stock Exchange and S&P400 Industrial Stock Price Index have been examined.

Pan *et al.* (2007) examined seven East Asian countries including Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand, for the period from January 1988 to October 1998. They found significant causal relation from exchange rates to stock prices for Hong Kong, Japan, Malaysia and Thailand before the 1997 Asian crisis. They also found that, during the Asian crisis, all countries except Malaysia show a causal relation from exchange rates to stock prices while no country shows a significant causality from stock prices to exchanges rates. These findings show that there is causal relation from exchange rates to stock prices before crisis but there is no causal relation during crisis in Malaysia.

Moreover, Ghazali *et al.* (2008) also examined the relationship between stock prices and exchange rates in Malaysia for the period before Asian crisis (December 3, 1993 – July 1, 1997), during Asian crisis (July 2, 1997 – September 1, 1998) and after Asian crisis (July 22, 2005 – June 8, 2007) or when Malaysia ringgit was unpegged. The Toda-Yamamoto causality test found that there is no causality during the pre-crisis and crisis periods but there is a uni-directional causality running from stock prices to exchange rates after the 1997 crisis. Ghazali *et al.* (2008) and Pan *et al.* (2007)